

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): An anisotropic material comprising an alternating-line pattern and a layer of at least one functional compound selected from the group consisting of a semiconductor compound, an electrically conductive compound, a photochromic compound and a thermochromic compound, formed on a surface of the alternating-line pattern, wherein one type of lines in the alternating-line pattern surface comprises a fluorine-containing compound, the fluorine-containing compound is at least one fluorine-containing organic silane compound, ~~fluorine-containing organic thiol compound, fluorine-containing organic disulfide compound, or fluorine-containing organic phosphate ester compound,~~ selected from the group consisting of:

(a) a fluorine compound of the formula:

Rf-A-SiX₃, or

Rf-O-A-SiX₃,

wherein Rf is a branched perfluoroalkyl group having 3 to 5 carbon atoms,

A is an alkylene group having 1 to 4 carbon atoms,

A -SO₂N(R²¹)R²²- group provided that R²¹ is an alkyl group having 1 to 4 carbon atoms, and R²² is an alkylene group having 1 to 4 carbon atoms or a -CH₂CH(OH)CH₂- group, and

X is a hydrogen atom, a halogen atom, or OC_nH_{2n+1} wherein n is 1 to 4,

~~which has a branched perfluoroalkyl group having 5 or less carbon atoms,~~

(b) a fluorine compound having a perfluoropolyether group of the formula:

PFPE-A-SiX₃,

wherein PFPE is a perfluoropolyether group,

A is an alkylene group having 1 to 4 carbon atoms,

a -SO₂N(R²¹)R²²- group provided that R²¹ is an alkyl group having 1 to 4 carbon atoms, and R²² is an alkylene group having 1 to 4 carbon atoms or a -CH₂CH(OH)CH₂- group, and

X is a hydrogen atom, a halogen atom, or OC_nH_{2n+1} wherein n is 1 to 4

~~(c) a fluorine compound having a polymer structure obtained by polymerizing a monomer which has a perfluoroalkyl group having 5 or less carbon atoms, and of the formula:~~

Polymer-D-SiX₃,

wherein Polymer represents a polymer structure group obtained by polymerizing a perfluoroalkyl group-containing monomer represented by the general formula:

R_f-A-OC(=O)CR³=CH₂

wherein R_f is a straight-chain or branched perfluoroalkyl group having 1 to 5 carbon atoms,

R³ is a hydrogen atom, an F atom, a Cl atom, a CF₃ group, a CF₂H group, a CFH₂ group or a methyl group, and

A is an alkylene group having 1 to 4 carbon atoms, a -SO₂N(R²¹)R²²- group provided that R²¹ is an alkyl group having 1 to 4 carbon atoms, and R²² is an alkylene group having 1 to 4 carbon atoms or a -CH₂CH(OH)CH₂- group, D represents -S(CH₂)₂OCONH(CH₂)_q- wherein p and q are 1 to 4, or -CH₂CH₂-, and

X represents a hydrogen atom, a halogen atom, or OC_nH_{2n+1} wherein n is 1 to 4, and

~~(d) a fluorine compound having a linking group which is any one of an urethane group, an ester group, an ether group and an amide group, existing between a perfluoroalkyl group having 5 or less carbon atoms and a functional group which is a silane group, a thiol group, a disulfide group or a phosphoric acid group; or of the formula:~~

R_f-A-Z-A'-SiX₃

wherein R_f represents a perfluoroalkyl group having 5 or less carbon atoms,

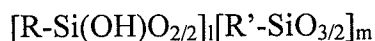
A and A' represent an alkylene group having 1 to 4 carbon atoms, a -SO₂N(R²¹)R²²- group provided that R²¹ is an alkyl group having 1 to 4 carbon atoms, and R²² is an alkylene group having 1 to 4 carbon atoms or a -CH₂CH(OH)CH₂- group,

Z is a urethane group, an ester group, an ether group or an amide group, and

X is a hydrogen atom, a halogen atom, or $\text{OC}_n\text{H}_{2n+1}$ wherein n is 1 to 4, or

the fluorine-containing compound is at least one selected from the group consisting of:

(e) an incompletely-condensed silsesquioxane which has a perfluoroalkyl group having 5 or less carbon atoms, represented by the general formula:



wherein R and R' represent Rf, Rf-A, an alkyl group having 1 to 22 carbon atoms, or a derivative of an alkyl group having 1 to 22 carbon atoms provided that at least one of R and R' is Rf or Rf-A wherein Rf represents a perfluoroalkyl group having 5 or less carbon atoms, and A represents an alkylene group having 1 to 4 carbon atoms, a $-\text{SO}_2\text{N}(\text{R}^{21})\text{R}^{22}$ - group provided that R^{21} is an alkyl group having 1 to 4 carbon atoms, and R^{22} is an alkylene group having 1 to 4 carbon atoms or a $-\text{CH}_2\text{CH}(\text{OH})\text{CH}_2$ - group, and l and m represent such a number that a molecular weight of the incompletely-condensed silsesquioxane is within a range from 500 to 100000, and

(f) a completely-condensed silsesquioxane which has a silane group and a perfluoroalkyl group having 5 or less carbon atoms, represented by the formula:



wherein R represents Rf, Rf-A, an alkyl group having 1 to 22 carbon atoms, or a derivative of an alkyl group having 1 to 22 carbon atoms provided that at least one of R is Rf or Rf-A wherein Rf represents a perfluoroalkyl group having 5 or less carbon atoms, A represents an alkylene group having 1 to 4 carbon atoms, a $-\text{SO}_2\text{N}(\text{R}^{21})\text{R}^{22}$ - group provided that R^{21} is an alkyl group having 1 to 4 carbon atoms, and R^{22} is an alkylene group having 1 to 4 carbon atoms or a $-\text{CH}_2\text{CH}(\text{OH})\text{CH}_2$ - group, R' represents an organic group containing SiX_3 , wherein X is a hydrogen atom, a halogen atom or $\text{OC}_n\text{H}_{2n+1}$ where n=1 to 4 and l and m represent such a number that a molecular weight of the completely-condensed silsesquioxane is within a range from 500 to 100000.

2. (previously presented): The anisotropic material according to claim 1, wherein a difference between surface free energy of the type of lines comprising the fluorine compound and surface free energy of the other type of lines is at least 5 mJ/m^2 .

3. (original): The anisotropic material according to claim 1, wherein the alternating-line pattern has a line width of 0.5 to 100 μm .

4. (original): The anisotropic material according to claim 1, wherein the alternating-line pattern has unevenness of not more than 10 nm.

5. (original): The anisotropic material according to claim 1, wherein the shape of droplets is distorted when 2 μL of ethanol is gently dropped from above the alternating-line pattern, and the degree of distortion is at least 1.1 in terms of a ratio L/W of the length in a major axis (L) to the length in a minor axis (W) of droplets.

6. (canceled).

7. (withdrawn-currently amended): A method for producing an anisotropic material comprising an alternating-line pattern and a layer of at least one functional compound selected from the group consisting of a semiconductor compound, an electrically conductive compound, a photochromic compound and a thermochromic compound, formed on a surface of the alternating-line pattern, wherein one type of lines in the alternating-line pattern surface comprises a fluorine-containing compound, the fluorine-containing compound is at least one fluorine-containing organic silane compound, ~~fluorine-containing organic thiol compound,~~ ~~fluorine-containing organic disulfide compound, or fluorine-containing organic phosphate ester compound,~~ selected from the group consisting of:

(a) a fluorine compound ~~which has a branched perfluoroalkyl group having 5 or less carbon atoms, of the formula:~~

Rf-A-SiX_3 , or

Rf-O-A-SiX_3 ,

wherein Rf is a branched perfluoroalkyl group having 3 to 5 carbon atoms,

A is an alkylene group having 1 to 4 carbon atoms,

A - $\text{SO}_2\text{N}(\text{R}^{21})\text{R}^{22}$ - group provided that R^{21} is an alkyl group having 1 to 4 carbon atoms, and R^{22} is an alkylene group having 1 to 4 carbon atoms or a - $\text{CH}_2\text{CH}(\text{OH})\text{CH}_2$ - group, and

X is a hydrogen atom, a halogen atom, or $\text{OC}_n\text{H}_{2n+1}$ wherein n is 1 to 4,

(b) a fluorine compound having a perfluoropolyether group of the formula:

PFPE-A-SiX₃,

wherein PFPE is a perfluoropolyether group,

A is an alkylene group having 1 to 4 carbon atoms,

a -SO₂N(R²¹)R²²- group provided that R²¹ is an alkyl group having 1 to 4 carbon atoms,
and R²² is an alkylene group having 1 to 4 carbon atoms or a -CH₂CH(OH)CH₂- group, and

X is a hydrogen atom, a halogen atom, or OC_nH_{2n+1} wherein n is 1 to 4,

~~(c) a fluorine compound having a polymer structure obtained by polymerizing a monomer~~
~~which has a perfluoroalkyl group having 5 or less carbon atoms, and of the formula:~~

Polymer-D-SiX₃,

wherein Polymer represents a polymer structure group obtained by polymerizing a
perfluoroalkyl group-containing monomer represented by the general formula:

R_f-A-OC(=O)CR³=CH₂

wherein R_f is a straight-chain or branched perfluoroalkyl group having 1 to 5 carbon
atoms,

R³ is a hydrogen atom, an F atom, a Cl atom, a CF₃ group, a CF₂H group, a CFH₂ group
or a methyl group, and

A is an alkylene group having 1 to 4 carbon atoms, a -SO₂N(R²¹)R²²- group provided that
R²¹ is an alkyl group having 1 to 4 carbon atoms, and R²² is an alkylene group having 1 to 4
carbon atoms or a -CH₂CH(OH)CH₂- group, D represents -S(CH₂)₂OCONH(CH₂)_q- wherein p
and q are 1 to 4, or -CH₂CH₂-, and

X represents a hydrogen atom, a halogen atom, or OC_nH_{2n+1} wherein n is 1 to 4, and

~~(d) a fluorine compound having a linking group which is any one of an urethane group,~~
~~an ester group, an ether group and an amide group, existing between a perfluoroalkyl group~~
~~having 5 or less carbon atoms and a functional group which is a silane group, a thiol group, a~~
~~disulfide group or a phosphoric acid group; or of the formula:~~

R_f-A-Z-A'-SiX₃

wherein R_f represents a perfluoroalkyl group having 5 or less carbon atoms,

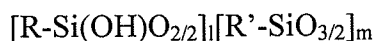
A and A' represent an alkylene group having 1 to 4 carbon atoms, a $-\text{SO}_2\text{N}(\text{R}^{21})\text{R}^{22}-$ group provided that R^{21} is an alkyl group having 1 to 4 carbon atoms, and R^{22} is an alkylene group having 1 to 4 carbon atoms or a $-\text{CH}_2\text{CH}(\text{OH})\text{CH}_2-$ group,

Z is a urethane group, an ester group, an ether group or an amide group, and

X is a hydrogen atom, a halogen atom, or $\text{OC}_n\text{H}_{2n+1}$ wherein n is 1 to 4, or

the fluorine-containing compound is at least one selected from the group consisting of:

(e) an incompletely-condensed silsesquioxane which has a perfluoroalkyl group having 5 or less carbon atoms, represented by the general formula:



wherein R and R' represent Rf, Rf-A, an alkyl group having 1 to 22 carbon atoms, or a derivative of an alkyl group having 1 to 22 carbon atoms provided that at least one of R and R' is Rf or Rf-A wherein Rf represents a perfluoroalkyl group having 5 or less carbon atoms, and A represents an alkylene group having 1 to 4 carbon atoms, a $-\text{SO}_2\text{N}(\text{R}^{21})\text{R}^{22}-$ group provided that R^{21} is an alkyl group having 1 to 4 carbon atoms, and R^{22} is an alkylene group having 1 to 4 carbon atoms or a $-\text{CH}_2\text{CH}(\text{OH})\text{CH}_2-$ group, and l and m represent such a number that a molecular weight of the incompletely-condensed silsesquioxane is within a range from 500 to 100000, and

(f) a completely-condensed silsesquioxane which has a silane group and a perfluoroalkyl group having 5 or less carbon atoms, represented by the formula:



wherein R represents Rf, Rf-A, an alkyl group having 1 to 22 carbon atoms, or a derivative of an alkyl group having 1 to 22 carbon atoms provided that at least one of R is Rf or Rf-A wherein Rf represents a perfluoroalkyl group having 5 or less carbon atoms, A represents an alkylene group having 1 to 4 carbon atoms, a $-\text{SO}_2\text{N}(\text{R}^{21})\text{R}^{22}-$ group provided that R^{21} is an alkyl group having 1 to 4 carbon atoms, and R^{22} is an alkylene group having 1 to 4 carbon atoms or a $-\text{CH}_2\text{CH}(\text{OH})\text{CH}_2-$ group, R' represents an organic group containing SiX_3 , wherein X is a hydrogen atom, a halogen atom or $\text{OC}_n\text{H}_{2n+1}$ where n=1 to 4 and l and m represent such a number that a molecular weight of the completely-condensed silsesquioxane is within a range from 500 to 100000,

which method comprises applying a solution of at least one functional compound selected from the group consisting of a semiconductor compound, an electrically conductive compound, a photochromic compound and a thermochromic compound on the surface of an alternating-line pattern, one type of lines of which comprises a fluorine-containing compound.

8. (withdrawn): The method according to claim 7, wherein a liquid which dissolves the functional compound is a solvent having a surface tension of not more than 30 mN/m.

9. (withdrawn): A method for producing a functional material, comprising using, as a template, a pattern surface composed of plural regions each having different surface free energy, characterized in that:

(1) at least one region of the pattern surface is treated with a fluorine compound, and

(2) the method comprises applying a functional compound solution on the pattern surface and removing a solvent.

10. (canceled).

11. (withdrawn): A functional material produced by the method according to claim 9.

12. (withdrawn): A method for producing a functional material, which comprises applying a functional compound to a pattern surface having at least one region surface-treated with a fluorine compound.

13. (withdrawn): The method according to claim 12, wherein the fluorine compound comprises a fluorine compound having the following structure:

(a) a fluorine compound which has a branched fluoroalkyl group having 5 or less carbon atoms,

(b) a fluorine compound having a perfluoropolyether group,

(c) a fluorine compound having a polymer structure obtained by polymerizing a monomer which has a fluoroalkyl group having 5 or less carbon atoms,

(d) a fluorine compound having a linking group which is any one of an urethane group, an ester group, an ether group and an amide group, existing between a fluoroalkyl group having 5 or less carbon atoms and a functional group,

(e) an incompletely-condensed silsesquioxane which has a fluoroalkyl group having 5 or less carbon atoms, and

(f) a completely-condensed silsesquioxane which has a silane group and a fluoroalkyl group having 5 or less carbon atoms.

14. (withdrawn): A functional material produced by the method according to claim 12.

15. (previously presented): An anisotropic material according to claim 1, wherein both lines of the alternating-line pattern are made of a monomolecular film.

16. (previously presented): The anisotropic material according to claim 1, wherein the layer of the at least one functional compound has a thickness of from 0.1 nm to 100 μm .

17. (currently amended): The anisotropic material according to claim 1, wherein the ~~one type of lines in the alternating-line pattern surface comprises a fluorine-containing organic silane compound having a branched perfluoroalkyl group having 5 or less carbon atoms~~ comprises compound (a).

18. (canceled).